NASA Procedural Requirements

NPR 7120.5E
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COMPLIANCE IS MANDATORY

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Request Notification of Change (NASA Only)

Subject: NASA Space Flight Program and Project Management Requirements w/Changes 1-15

Responsible Office: Office of the Chief Engineer

Appendix F. Project Formulation Agreement Template

F.1 Formulation Agreement Template Instructions

F.1.1 The Formulation Agreement represents the project's or single-project program's response to the Formulation Authorization Document. (See Appendix E.) It establishes technical and acquisition work that needs to be conducted during Formulation and defines the schedule and funding requirements during Phase A and Phase B for that work. The Agreement focuses on the project or single-project program activities necessary to accurately characterize the complexity and scope of the project or single-project program; increase understanding of requirements; and identify and mitigate high technical, acquisition, safety, cost, and schedule risks. It identifies and prioritizes the Phase A and Phase B technical and acquisition work that will have the most value and enables the project or single-project program to develop high-fidelity cost and schedule range estimates at KDP B and high-fidelity cost and schedule commitments at KDP C.

F.1.2 The Formulation Agreement serves as a tool for communicating and negotiating the project's or single-project program's Formulation plans and resource allocations with the program and Mission Directorate. It allows for differences in approach between competed versus assigned missions. Variances with NPR 7120.5 product maturities as documented in Appendix I of NPR 7120.5 are identified with supporting rationale in the Agreement. The approved Agreement serves as authorization for these variances. The Agreement is approved and signed at KDP A and is updated and resubmitted for signature at KDP B. The Formulation Agreement for KDP A includes detailed Phase A information and preliminary Phase B information. The Formulation Agreement for KDP B identifies the progress made during Phase A and updates and details Phase B.

F.1.3 Each section of the Formulation Agreement template is required.If a section is not applicable to a particular project or single-project program, the project or single-project program indicates that in the appropriate section and provides a rationale. If a section is applicable but the project or single-project program desires to omit the section or parts of a section, then a waiver or deviation needs to be obtained in accordance with the tailoring process for NPR 7120.5. (See Section 3.5.) Approvals for waivers are documented in the Compliance Matrix, and the Compliance Matrix for this NPR is attached to the Formulation Agreement. If the format of the completed project or single-project Formulation Agreement differs from this template, a cross-reference table indicating where the information for each template paragraph is needs to be provided with the document when it is submitted for the MDAA signature.

F.1.4 The approval signatures of MDAA, the Center Director, and the program manager certify that the Formulation Agreement implements all the Agency's applicable institutional requirements or that the owner of those requirements, e.g., Safety and Mission Assurance, has agreed to the modification of those requirements contained in the Formulation Agreement.

F.1.5 Products developed as part of or as a result of the Formulation Agreement may be incorporated into the Project or Single-Project Program Plan, if appropriate, as the Project or Single-Project Program Plan is developed during Formulation. The project or single-project program may use the preliminary Project or Single-Project Program Plan to describe and control the project's or single-project program's execution as long as the Project or

Single-Project Program Plan does not conflict with the Formulation Agreement.

F.2 Formulation Agreement Title Page

[*Project or Single-Project Program Name*] Formulation Agreement

[*short title or acronym*]

(Provide a title for the candidate project or single-project program and designate a short title or proposed acronym in parenthesis, if appropriate.)

_____	_____
Mission Directorate Associate Administrator	Date
_____	_____
Center Director (as many signature lines as needed)	Date
_____	_____
Program Manager	Date
_____	_____
Project Manager	Date

By signing this document, signatories are certifying that the content herein is acceptable as direction for managing this project or single-project program and that they will ensure its implementation by those over whom they have authority.

Figure F-1 Formulation Agreement Title Page

F.3 Formulation Agreement Template

[Project or Single-Project Program Name] Formulation Agreement

[short title or acronym]

1.0 Purpose

Describe the purpose of the program/project, including traceability from Formulation Authorization Agreement (FAD). (See Appendix E.)

2.0 Project or Single-Project Program Formulation Framework

Identify the project or single-project program organization chart for Formulation; identify the initial project or single-project program team, key personnel, and responsible Centers and partnerships (as known) that will contribute during Formulation. Define major roles and responsibilities and identify any Boards and Panels that will be used during Formulation for decision making and managing project or single-project program processes.

3.0 Project or Single-Project Program Plan and Project or Single-Project Program Control Plans

Document the project's or single-project program's proposed milestones for delivery of the Project or Single-Project Program Plan and project or single-project program control plans on the project or single-project program schedule and provide rationale for any differences from requirements in product maturities as documented in Appendix I of NPR 7120.5.

4.0 Project or Single-Project Program, System, and Subsystem Requirements Flow Down

Document the project's or single-project program's proposed milestones for flow down of requirements to the project or single-project program, system, and subsystem levels on the project or single-project program schedule, and provide rationale for any differences from requirements in product maturities as documented in Appendix I of NPR 7120.5. Document the project or single-project program schedule for development of any models needed to support

requirements development.

5.0 Mission Scenario, Architectures, and Interfaces

Document the project's or single-project program's proposed milestones for producing the mission concept, mission scenario (or design reference mission), concept of operations, and mission, spacecraft, payload, and ground systems architectures down to the level of subsystem interfaces. Include these milestones on the project or single-project program schedule and provide rationale for any differences from requirements documented in the tables in Appendix I of this NPR.

Reference documentation of the feasible concept, concepts already evaluated, and plans for additional concepts to be evaluated during Formulation. Documentation should include ground rules, assumptions, and constraints used for analysis; key architecture drivers, such as redundancy; preliminary key performance parameters; top-level technical parameters and associated margins; and preliminary driving requirements. Documentation should also include feasible candidate architectures; open architecture issues and how and when those issues will be resolved; basic descriptions of each element; and descriptions of interfaces between elements.

At KDP B update the approved concept and architecture, including a preliminary definition of the operations concept and updated description of composition of payload/suite of instruments. Identify the work required to close all architecture and architectural interface issues.

6.0 Trade Studies

[Identify spacecraft and ground systems design trade studies planned during phases A and B, including trade studies that address performance versus cost and risk.]

7.0 Risk Mitigation

[Document plans for managing risks during Formulation. Identify the project's or single-project program's major technical, acquisition, safety, cost, and schedule risks to be addressed during Formulation, including risks likely to drive the project's or single-project program's cost and schedule range estimates at KDP B, and cost and schedule estimates at KDP C. Describe the associated risk mitigation plans. Provide rationale for addressing these risks during Formulation.

Document the project's or single-project program's risk mitigation schedule and funding requirements. Include intermediate milestones and expected progress by KDP B and KDP C.]

8.0 Technology Readiness Assessment and Development

[Identify the specific new technologies (Technology Readiness Levels (TRL) less than 6) that are part of this project or single-project program; their criticality to the project's or single-project program's objectives, goals, and success criteria; and the current status of each planned technology development, including TRL and associated risks. Describe the specific activities and risk mitigation plans, the responsible organizations, models, and key tests to ensure that the technology maturity reaches TRL 6 by PDR. (Refer to NPR 7120.8 for TRL definitions.)

Identify off-ramp decision gates and strategies for ensuring there are alternative development paths available if technologies do not mature as expected. Identify potential cost, schedule, or performance impacts if the technology developments do not reach the required maturity levels.

Provide technology development schedules, including intermediate milestones and funding requirements, during Phases A and B for each identified technology development to achieve TRL 6 by PDR. Describe expected status of each technology development at SRR, MDR/SDR, and PDR. Reference the preliminary or final Technology Development Plan for details as applicable. Describe how the program will transition technologies from the development stage to manufacturing, production, and insertion into the end system. Identify any potential costs and risks associated with the transition to manufacturing, production, and insertion. Develop and document appropriate mitigation plans for the identified risks.]

9.0 Engineering Development Assessment, Prototyping, and Software Models

[Identify major engineering development risks and any engineering prototyping or software model development that needs to be accomplished during phases A and B to reduce development risk (Engineering development risks include components and assemblies that have not been previously built or flown in the planned environment or that have been significantly modified in functionality, interfaces, power consumption, size, or use of materials.). Provide rationale and potential impacts to project or single-project program performance, cost, and schedule if development risks are not addressed. Describe the scope of the prototyping and modeling activities and the expected reduction of cost and risk by performing this work during Formulation. Include the project or single-project program's testing philosophy, including functional, environmental, and qualification testing, any life testing and protoflight test plans, and rationale.

Describe the prototypes and software models to be built, their fidelity (form, fit, and function, etc.), test environments and objectives, and test dates. Identify any design alternatives if irresolvable problems are encountered.

Provide prototype and software model development and test schedules, including intermediate milestones and funding requirements during phases A and B. Describe expected status and accomplishments for each prototype or software model at SRR, MDR/SDR, and PDR.]

Focus during Phase A should be on component and subassembly prototypes built to approximately the correct size, mass, and power, with "flight-like" parts and materials, and tested in a laboratory environment over the extremes of temperature and radiation (if relevant). Focus during Phase B should be on testing form, fit, and function prototypes over the extremes of what will be experienced during flight.

Identify key performance parameters, associated modeling methodologies, and methods for tracking KPPs throughout Formulation. Identify key performance parameters, associated modeling methodologies, and methods for tracking KPPs throughout Formulation. In addition, identify any rocket propulsion testing and provide for analysis and selection of propulsion testing sites in accordance with NPD 8081.1, NASA Chemical Rocket Propulsion Testing.

10.0 Heritage Assessment and Validation

[Identify the major heritage hardware and software assumptions and associated risks and the activities and reviews planned to validate those assumptions during Formulation. Identify schedule and funding requirements for those activities.]

11.0 Acquisition Strategy and Long-lead Procurements

[Identify acquisition and partnership plans during Formulation. Document the project's or single-project program's proposed milestones for in-house work and procurements, including completing any Contract Statements of Work (SOW) and Requests for Proposal (RFP) during the Formulation phase. Identify long-lead procurements to be initiated and provide associated rationale. Identify procurements of material and services necessary for life-cycle sustainment. Identify anticipated partnerships (other government agencies and U.S. and international partners), if any, including roles and contributed items and plans for getting commitments for contributions and finalizing open inter-agency agreements, domestic partnerships, and foreign contributions. Point to the preliminary or final Acquisition Plan for details, as applicable.

Identify major acquisition risks, including long-lead procurement risks and partnership risks.

Identify funding requirements for procurement activities, long-lead procurements, and partnerships.]

12.0 Formulation Phase Reviews

[Identify and provide schedules for the project or single-project program life-cycle reviews (SRR, SDR/MDR) and the system and subsystem-level reviews to be held during Formulation. Include inheritance reviews, prototype design reviews, technology readiness reviews, fault protection reviews, etc., necessary to reduce risk and enable more accurate cost and schedule range estimates at KDP B and more accurate cost and schedule estimates at KDP C.]

13.0 Formulation Phase Cost and Schedule Estimates

[Document the project's or single-project program's Formulation Phase schedule and phased funding requirements, including cost and schedule margins, aligned with the project or single-project program Work Breakdown Structure (WBS). Identify the critical path.

Ensure that all funding requirements in this Agreement are included and clearly identifiable. Summarize funding requirements both in dollars and estimated percent of total costs phases A-D.

Ensure that the schedules for all technology development, engineering prototyping, procurement and risk mitigation activities, and milestones identified in this Agreement are included and clearly identifiable. Provide schedule details to the appropriate level to justify Formulation funding requirements (typically subsystem level).

Include any additional milestones required in product maturities as documented in Appendix I in NPR 7120.5, including the development of life-cycle cost and schedule ranges due at KDP B and the JCL at KDP C, if required.

Identify the schedule for developing the project's or single-project program's EVM capabilities, if EVM is required.

14.0 Leading Indicators

Project or single-project programs develop and maintain the status of a set of programmatic and technical leading indicators to ensure proper progress and management of the project or single-project program are achieved during Formulation. These include:

• Requirement Trends (percent growth, TBD/TBR (to be resolved) closures, number of requirement changes);

• Interface Trends (percent Interface Control Document (ICD) approvals, TBD/TBR burn down, number of interface requirement changes);

• Review Trends (Review Item Discrepancy (RID)/Request for Action (RFA)/Action Item burn down per review);

- Formulation Cost Trends (Plan, actual, UFE, NOA);
- Schedule Trends (slack/float, critical milestone dates);
- Staffing Trends (Full-Time Employee (FTE)/Work Year Equivalent (WYE));
- Technical Performance Measures (Mass margin, power margin); and
- Additional project or single-project program-specific indicators, as needed.

These indicators are further explained in the NASA Space Flight Program and Project Management Handbook and in a white paper on the Program and Project Management Communities of Practice Web site.

15.0 Appendices

Appendix A Acronyms
Appendix B Definitions
Appendix C Compliance Matrix for this NPR

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